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ABSTRACT

The four papers contained in this document provide: (1) a survey of computer based mail and conference systems; (2) an evaluation of systems for both individually addressed mail and group addressing through conferences and distribution lists; (3) a discussion of various methods of structuring the text data in existing systems; and (4) a description of the networks of interconnected systems: ARPANET, CSNET, BITNET, USENET, JNT-MAIL, EURNET, and MAILNET. Specific topics such as electronic mail, electronic publishing, structuring facilities, subconferences, keywords, simultaneous conferences, and mail networks are also described, and the differences between computer conferencing and electronic mail are explained and illustrated. A detailed description of the COM/PORTACOM computer conference system, which provides both computer mail and conference system services, is included, and the command structure of menus and listed commands used by the system are illustrated. A short summary of a report on experience with COM usage is included, together with a cost estimate (in Swedish kroner) for system utilization. An outline of the functions and implementations of COM/PORTACOM facilities is provided to explain the use of the system in detail. (JB)

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Survey of computer-based message systems

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This paper provides a survey of computer-based mail and conference systems. The paper discusses systems for both individually addressed mail and group addressing through conferences and distribution lists. Various methods of structuring the text data base in existing systems is discussed and the networks of interconnected systems (ARPANET, CSNET, BITNET, USENET, JNT-MAIL, EURNET, MAILNET etc.) are described. The emerging standards for the interconnection of message systems are described.

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The beginning: Electronic mail

As soon as people who previously met at the card reader got their own computer terminals, so that they could sit in their own room and use the terminal to communicate with the computer, a need for communication between all those people sitting at their different terminals arose. Often, the people at the terminals were spread in different places, even different cities, making communication through other means than the computer difficult. Thus, electronic mail was first born.

A typical simple electronic mail system has a set of messages sent to each user, often simply a set of files, one file for each message, stored in an area of the file system for incoming mail to this user. When someone writes a message to one or more other users, a copy of the file with the message is made for each recipient and stored in his area for incoming mail.

When a user reads his mail, one message at a time is displayed, and the user can choose whether to delete the message when read, keep it so that it will be shown again the next time s/he reads messages, or copy it to some other personal file.

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To make message writing simpler, some information in the message was filled in fully or partly automatically by the system. This could include calendar date and time, author name, and a list of other recipients of the same message. Thus, a delivered message will consist of two parts, a header and a body.

Distribution lists

To understand what happened after that, and why, note the effect of the fact that you read much faster than you write, first pointed out by Murray Turoff (see Turoff 1978).

The figure below compares the time efficiency of computer message communication versus face-to-face meetings with 12 participants:

Message system: Long writing time but short reading time:

Writing Reading
3.6 min. 11 times 0.47 = 5.2 minutes.
Total time 3.6 + 5.2 = 8.8 minutes.

Face-to-face meeting: Shorter speaking time but longer listening time:

Speaking and listening: 12 times 1.7 = 20.4 minutes.

The figure is based on statistics on use of the COM computer conference system.

The figure shows that the total time of communicating certain information to a group of 12 people is much less with computerized written communication than with spoken communication. This is not only caused by the difference between writing and reading time. Important is also that with written communication, each reader decides how much time to spend on each message. You can read an important message carefully, and skip fast across a less important message or a message saying things you already know.

In a face-to-face meeting, a common occurrence is that some person is saying certain things, and some other people would much prefer him to stop talking. He may be saying something they have already heard, or something of little value to them.

On the other hand, the same statement by the same person may be very important and valuable to other participants in the same meeting who have not heard it before.

Another side of the same coin is that a people will often not say, or be allowed to say, what they want because of lack of time or consideration for those who have heard it before. This can often mean that things which should have been said are left unsaid.

It is a well-known fact, that face-to-face meetings with more than about five or seven participants meet with psychological problems. These problems will not occur in a good computer message system until the group size becomes much larger, perhaps fifty or a hundred participants.

Thus, computer messaging is especially advantageous when communication with many other people. This soon led to the addition, in computer message systems, of a facility called "distribution list". This is a facility for sending a message to a group of people by just inputting the name of the list instead of inputting the names of all the individual members of the list.

And experience shows that a very large percentage of messages are sent via distribution lists. In the COM system, for example, which supports conferences (a kind of distribution lists) and individually addressed mail equally well, more than 90 % of all messages read are sent via conferences.

Information overload

If all messages were sent from one person to one other person, information overload would very seldom occur, since the time to write a message is so much larger than the time to read that people would spend most of their time writing, and only a little time reading.

With the advent of distribution lists, however, it becomes as easy to send a message to ten or a hundred or even more people than to send it to only one person. And the fact that computer mail sys-

tems make it so easy, through distribution lists, to send the same message to very many people, is the main cause of the information overload problem.

When message systems grow larger, or get connected via networks, the audience you can reach with a message gets larger, the distribution lists get longer, and the information overload problems get worse.

Electronic publishing

One should here note that mail systems with distribution lists are conceptually close to electronic publishing. Electronic publishing is also the distribution of a text document to many people, just as distribution lists.

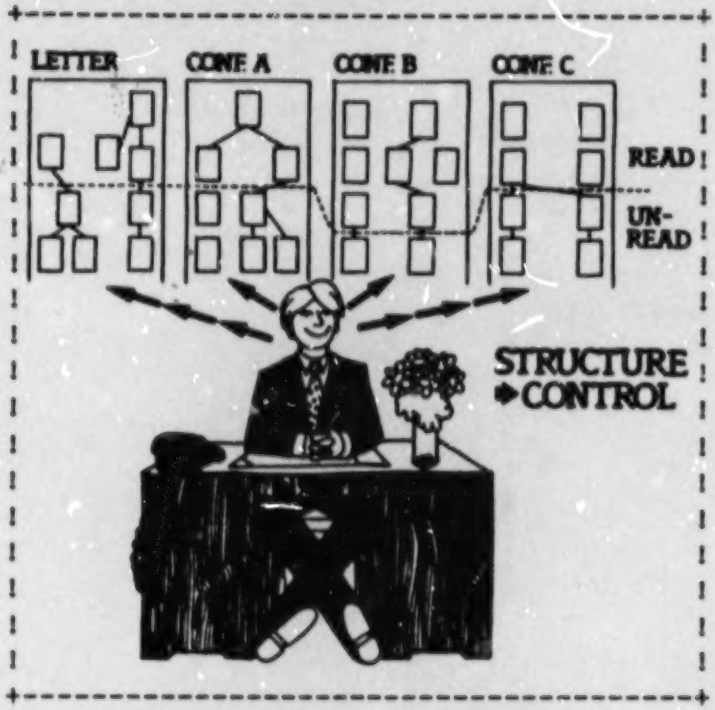
We thus have a spectrum of different systems for electronic dissemination of text:

- Person-to-person letters.
- Distribution lists.
- Computer conferences or bulletin boards.
- Questions and answers.
- Voting.
- Electronic publishing.
- Archiving and retrieval systems.

Videotex systems are also a special way of handling similar things.

Since there is no sharp limit between these different functions, and since the same text item may during its life e.g. first be an electronic mail to an editor, and later be a paper in an electronic journal, future systems will probably be required to support well all the alternatives in the table above.

Avoiding information overload



To avoid information overload, a system must give the recipients of messages better ability to choose what they want to read and not to read.

This is achieved by putting a structure on the set of messages, so that already when you connect to a system, the messages are ordered to allow you to choose what to read.

A common such structure is the computer conference. When you connect to a typical computer conference system, you may get a list of what you have not read in the different conferences, such as is shown below:

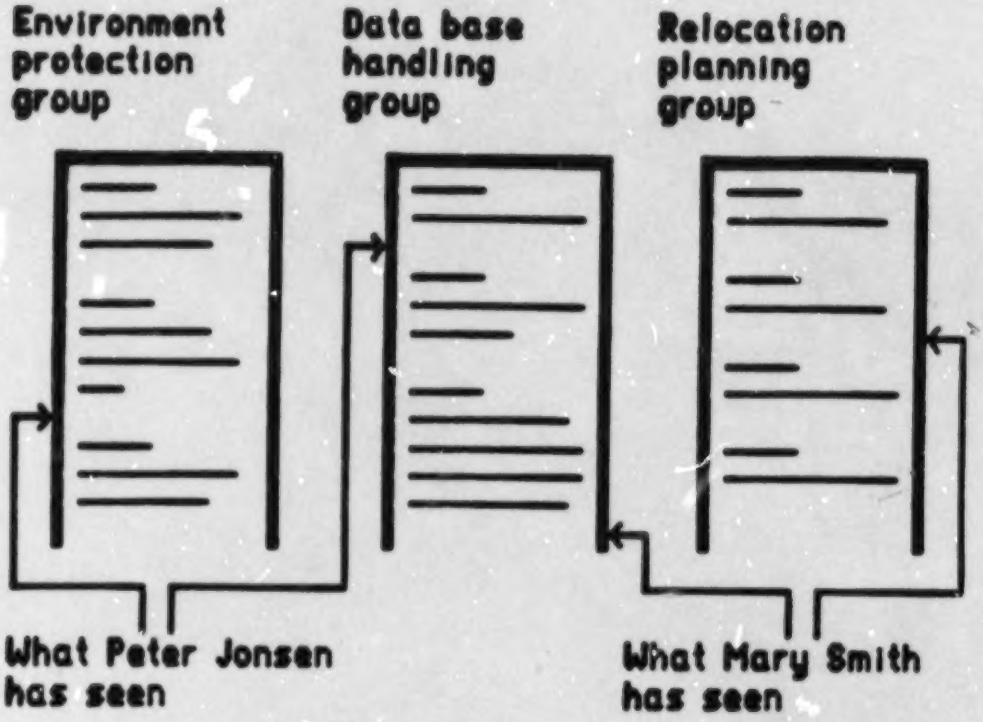
```
You have 5 unseen letters
2 unseen entries in GILT meeting
13 unseen entries in Supercomputers
5 unseen entries in English language
6 unseen entries in Conference announcements
19 unseen entries in Speakers corner
19 unseen entries in User presentations
1 unseen entries in Fifth generation project
18 unseen entries in Packet-switched networks
11 unseen entries in Microcomputers
5 unseen entries in TeX inter-network list
1 unseen entries in KERMIT experience
34 unseen entries in TOPS-10/20 SIG

You have 134 unseen entries
```

Every message which was sent to the user via a computer conference (distribution list, bulletin board) is also delivered to him as an entry in that conference. The user normally will read one conference at a time. The users decide themselves in which order to read the

conferences, and they can save some conferences to read at a later time. If they get too much information, they can also withdraw completely from conferences they are not interested in, or skip part of the discussion in that conference but still stay as a member.

For every user who is a member of a conference, a conference system keeps a counter of how far this user has read in the list of messages in this conference. The user is shown only new messages when connecting to the system. Users can however review old messages if they wish to do so.


Environment protection group
Data base handling group
Relocation planning group
What Peter Jonsen has seen
What Mary Smith has seen

This figure shows the main principles of the news control facility in a computer conference system. In the figure, Peter Jonsen is a member of the first and second conference, and Mary Smith is a member of the second and third conference. There is a pointer in the data base for each person and each conference of which this person is a member. This pointer shows how far that person has read. Thus, users can enter the system at different times, and the system can show each user what is new to that user.

Other structuring facilities

Experience with computer conferencing shows that there is a need for structuring of the message data base on a more detailed level than that provided by conferences.

Subconferences

Some systems provide an explicit mechanism for splitting up a conference into subconferences. One example of this is the "topics" facility first introduced into the EIES computer conference system and later used in the PARTICIPATE conference system.

In topics, every new subject taken up in a conference becomes a new subconference, and each participant in the main conference is given the option of joining or not joing the subconference.

The topics structure is a very powerful tool for controlling information overflow. In fact, it is so powerful that it can completely kill all activity in a conference by splitting up the participants into too many subgroups with too few participants in each subgroup.

In EIES, you can choose whether to use the topics facility or not for a conference.

Keywords

Another structuring facility is the use of keywords. Authors are asked to give messages keywords, and readers can instruct the system to only show messages with certain keywords. A disadvantage with this is that the reader will sometimes get a rather fragmented picture of what is happening, with one message here and one message there.

One should here note that the concept of conference the way it is implemented in some systems, and the concept of keyword are very similar. Giving a message the two keywords "Pascal programming language" and "human-computer interaction", or linking the message to two conferences with the same name, are really two ways of doing the same things.

Links between entries

A common structure in many systems are various links between items. Thus, in COM/PortaCOM, users are encouraged by the command structure to link entries into tree structures of entries commenting on each other. In EIES, there is a facility for defining a "walk through path" as a chain of messages in the system.

Special kinds of conferences

Write-protected and selection conferences (containing selected items from other conferences), and abstracts of discussions written by some participants for those who do not wish to take part in the whole conference, are also common facilities.

Shelves and folders

Some designs of office automation systems structure documents into shelves and folders. The idea is that since these are common ways of structuring non-electronic messages, they will be easy to use and understand. I am however not convinced that the best way to design a computerized document handling system is to try to closely mirror the non-electronic world. Computers have different properties than non-electronic document handling, for example the ability to handle references and links between documents, and to store one and the same document in many places without actually copying the text of the document, and a good system should exploit these properties of a computer.

However, the best solution might be to use a computer-oriented structure internally, but show this to novice users in a simplied way using concepts like shelves and folders in the beginning, until they become accustomed to the more advanced structures which the computer actually can offer.

Simultaneous conferences

A simultaneous conference is a computer conference in which all participants are sitting at the same time at their terminals connected to the system. With a non-simultaneous conference, the news control facility in the system allows a conference to go on (usually over many days) even though every member only joins now and them and not all at the same time.

Experience has shown that computer conference systems are seldom used for simultaneous conferences, even if the software supports this mode of operation. The advantages of non-simultaneous conferences (better control of your time) seem to outweigh the advantages of simultaneous conferences (faster interaction).

Conference systems versus networks

Computer mail and conference systems actually grew in two different communities. One of them was the computer conference system community. They typically developed large, data base oriented systems with lots of structuring facilities, which were used stand-alone and not interconnected.

The EMISARI system, designed by Murray Turoff in 1971, and the PLANET-FORUM system (on DEC-10/20 computers) designed by Jacques Vallee at the Institute of the Future at about the same time, were the first of these systems. Later, Murray Turoff moved to the the New Jersey Insti-

tute of Technology where he designed the EIES system on Perkin-Elmer computers and Jacques Vallee founded a new company called Infomedia Corp., which today markets a conference system called NOTEPAD. The CONFER system runs under the MTS operating system for IBM-type computers. Well-known is also the german KOMEX system, developed by the GMD in Darmstadt for Siemens computers. The COM system was developed by the Swedish Defense Research Institute for DEC-10/20 computers. PortaCOM is a version of COM which runs under a multitude of different computer models and operating systems. COM and PortaCOM are today marketed by the QZ computer centre in Stockholm.

The other community was the network mail community which grew around the ARPANET. This computer network links many universities and research laboratories in the United States. Beginning with simple file transfer systems, the mail systems on the individual computers in the network began to exchange mail items. This has grown into networks of hundreds of linked computers and using large distribution lists in ways very similar to the conferences in the computer conference systems.

The network mail community has grown in a more haphazard manner, and do not provide the same coherent structure as a welldesigned computer conference system. Usually, the facilities for structuring and reducing information overload is much less powerful than in conferencing systems.

On the other hand, the facility of joing together hundreds of computers at different places is a strong advantage of the network mail community.

I therefore believe that a joining of the best ideas from the two communities would generate better ideas for the future. This has not happened until very recently, when the MAILNET network started by EDUCOM has finally succeeded in getting COM and EIES connected into the electronic mail networks in 1983.

Mail networks today

ARPANET still lives strongly, and has been split into two networks, MILNET for military applications and ARPANET for non-military applications, both of which together are called INTERNET. ARPANET uses leased lines.

CSNET joins computer science computers in the United States and works closely together with ARPANET. CSNET uses ARPANET in combination with dial-up phone and packet-net lines.

BITNET started with IBM computers, but today also joins many non-IBM-type computers. A European continuation of BITNET called EARNET is under development supported by IBM. BITNET uses store-and-forward techniques based on leased lines.

VNET is an IBM internal network.

DECNET is a network standard for connecting computers from Digital Equipment Corporation, and which also has a mail transfer standard.

USENET is a network of UNIX computers all around the world. USENET uses store-and-forward techniques mostly based on dial-up-lines.

JANET (formerly JNT-MAIL, SERCNET) is a british network.

MAILNET is a network of university computing centers, mostly in the United States, managed by EDUCOM (Interuniversity Communications Council). MAILNET uses one central computer for all mail forwarding, and dial-up phone or packet-net lines.

PHONENET is not really a net, but rather a description of the technique of using dial-up phone lines for collecting and re-distributing messages usually two or three times a day. This technique is used by CSNET, MAILNET and USENET.

Several gateways, some official and some unofficial, link the above networks so that in most cases a message can be sent between any two computers in the networks if you know the right way to route the message.

An interesting difference is in the way these networks are funded. Some networks are funded by central funds, or by a fixed participation fee, independent of how many messages you send. Other networks charge a fee per message. This causes some problems with gateways, since the systems funded centrally or by fixed fees have no way of handling charges for messages sent to networks which charge for each individual message.

Interconnection standards

In order to connect mail systems on different computers, a standard for the interaction between the systems and for message formatting is needed.

The oldest such standard was that used by ARPANET. CSNET, BITNET, USENET, MAILNET and JNT-MAIL and many other networks use slightly modified versions of the ARPANET standards. The standard was from the beginning not centrally developed, rather it grew gradually and was only later encoded on paper.

A big problem with the ARPANET mail standards is that the description in the standards documents do not agree with actual usage. This means that those who develop an interface, following the standards document, will soon find that this interface will not work very well. There are a number of more-or-less unwritten rules, both restrictions and extensions to the standard, which you have to obey.

The only standards in widespread use today (1984) except for company-internal nets are those deriving from the ARPANET standards.

The latest versions of the ARPANET standards are described in the documents RFC821 (interaction between mail systems), RFC822 (message formatting) and RFC819 (addressing).

There is an american Federal Information Processing Standard FIPS 98 for formatting messages when sent between message systems.

The CCITT is developing a new standard, which will probably be ready in 1984.

The COST-11-bis project, jointly funded by nine European Countries, has developed a standard called GILT.

Here is a summary of the functions provided by the three main different standards today:

Function	ARPA	CCITT	GILT
The sending of a message on the initiative of the sender.	Yes	Yes	Yes
The sending of a message on the initiative of the receiver.	No	No	Yes
Finding out where a certain mailbox resides.	Yes	Yes	Yes
Use of relaying in the normal distribution of a message.	Yes	Yes	No
Receipt and nondelivery notification.	No	Yes	Yes
Distribution lists, computerized bulletin boards and conferences.	No	No	Yes
Searching and retrieval in a message data base.	No	No	Yes

General note: Many of the functions described above are provided locally by some systems even though there is no support in the standard for them. For example, there are many distribution lists sent via the ARPANET standards, but the lack of support for this in the standards causes some problems. The lack of a standard for receipt and non-delivery notification in the ARPANET standard is also a cause of difficulty.

Networks with slow distribution times have a problem with several people answering the same question or making the same comment simultaneously, not knowing of each other. Faster networks will reduce this problem, since they will increase the probability that the message by the other person is already available when someone writes his comment.

Store-and-forward technology, where a message is stored and retransmitted by several intermediate computers, can sometimes be rather slow, for example in USENET and PHONENET. Transmitting a message by direct connection between sender and receiver, such as in ARPANET or GILT, will reduce the problems with slow transmission times.

Network etiquette

An interesting facet of these electronic message systems and networks is the growth of special behaviour patterns and etiquette rules neccessary for a wellworking network.

As an example, the lack of visual and audio clues to the intention of what you say means that a serious and an ironical statement are often mistaken. Because of this, some systems have developed special punctuation to mark ironical statements, like:

(. This is not a serious statement.)

Also, there is a problem of avoiding the wrong message in the wrong conference/distribution list, like sending a message "please delete me from this list" to all 200 members of a list. To avoid this, some lists employ a delay time with censoring of messages before redistribution from the list manager.

This will however delay message handling. A better way might be to include in the message standards ways for a list manager to delete messages even after they have been sent out. This facility is however not present in any of the existing interconnection standards.

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Only an abbreviated list of references is given here. For further references, see the book "computer-mediated communication systems" referenced below, which has a very complete list of references in the area.

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COM/PortaCOM conference system Design goals and principles

Abstract

The COM/PortaCOM™ computer conference system has been designed to be both easy to use for the novice user and powerful for the experienced user at the same time. This goal is achieved by having a powerful general-purpose basic data base structure, and by providing a user interface where the novice can understand the data base structure based on a simple model in the beginning, and then enhance this model with more experience with the system. The command structure combines menu-s and commands to suit both novice users and experienced users with the same user interface.

Introduction

The COM and PortaCOM computer mail and conference systems are functionally very similar. The difference is that COM can only be used on DECsystem-10/20 computers, while PortaCOM runs today on Univac 1100 and Norsk Data Nord 100 comuters and will be available on IBM, Control Data, Siemens, Burroughs and Digital Vax/11 computers.

COM and PortaCOM were designed with the following design goals:

- Easy to use for novice users even without prior training.
- Large power and flexibility for advanced users.
- Flexible distribution of control over the communication process.

The systems were developed in close cooperation with actual and future users, using first the FORUM computer conference system and, when COM was ready, COM itself.

COM and PortaCOM are functionally to a large extent identical, but there are some small differences. At a few places in this paper, a feature is described as it works in one of the systems, which may be a little different in the other system.

The message data base is structured

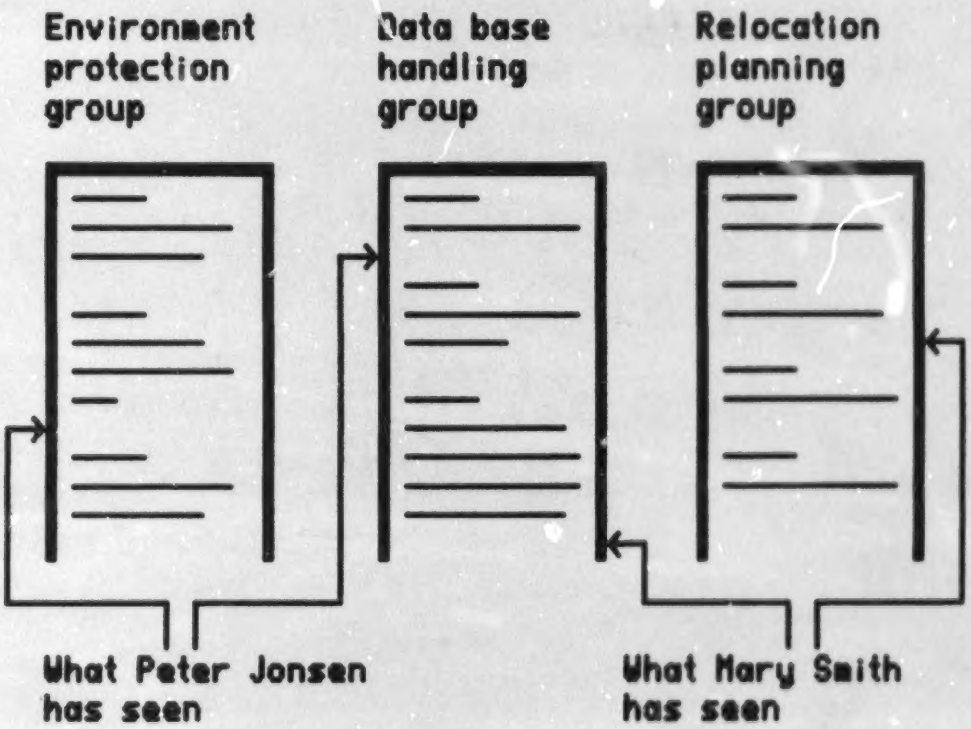
The data base of messages is structured in COM as in all computer conference systems. Instead of telling a user that "You have 134 unread mail, do you want to read them now?" the system gives a structured display of unread messages, as is shown by the following example of a printout from the system:

```
You have 5 unseen letters
You have 2 unseen entries in GILT open meeting
You have 13 unseen entries in Supercomputers
You have 5 unseen entries in English language
You have 6 unseen entries in Announcement (of new) conferences
You have 19 unseen entries in Speakers corner
You have 19 unseen entries in Presentation (of new) COM users
You have 1 unseen entries in Fifth generation computer project
You have 18 unseen entries in Packet-switched network use
You have 11 unseen entries in Microcomputers
You have 5 unseen entries in TeX inter-network mailing list
You have 1 unseen entries in KERMIT experience
You have 34 unseen entries in TOPS-10/20 SIG

You have 134 unseen entries
```

Every message which was sent to the user via a computer conference (distribution list, bulletin board) is also delivered to him as an entry in that conference. The user normally will read one conference at a time. The users decide themselves in which order to read the conferences, and they can save some conferences to read at a later time. If they get too much information, they can also withdraw completely from conferences they are not interested in, or skip part of the discussion in that conference but still stay as a member.

For every user who is a member of an conference, the system keeps a counter of how far this user has read in the list of messages in this conference. The user is shown only new messages when connecting to the system. Users can however review old messages if they wish to do so.


Environment protection group
Data base handling group
Relocation planning group
What Peter Jonsen has seen
What Mary Smith has seen

This figure shows the main principles of the news control facility in COM/PortaCOM. In the figure, Peter Jonsen is a member of the first and second activity, and Mary Smith is a member of the second and third activity. There is a pointer in the data base for each person and each activity of which this person is a member. This pointer shows how far that person has read. Thus, users can enter the system at different times, and the system can show each user what is new to that user.

Subconferences = comment trees

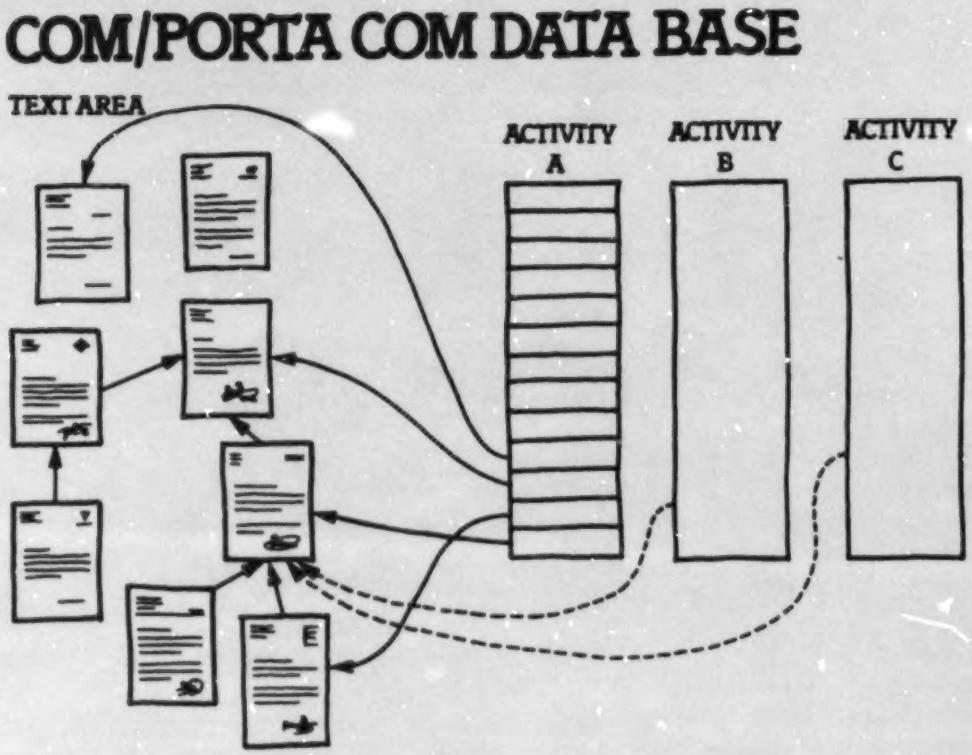
Experience with computer conferencing shows that there is a need for structuring of the message data base on a more detailed level than that provided by conferences. There is a need for a substructure, something which could be called subconferences. Such a structure can be used to read one subconference at a time, so as to read messages belonging together before switching to the next subconference. Subconferences can also be used in news control, to allow a user to skip reading the entries in a certain subconference, and for retrieval, by retrieving all or some of the entries in a particular subconference.

To start a new conference in COM/PortaCOM takes less than five minutes, but experience still shows that users are reluctant to start new conferences to the degree which is really neccessary to get a suitable subconference structure. Because of this, the users need not give any explicit command to start a subconference. Instead, COM/PortaCOM has a command structure which encourages users to write new entries as comments on previous entries, with an explicit link in the data base between the commenting and the commented entry. More than 80 % of all notices written in COM have such comment links to previous entries.

The set of all entries linked together by such comment links will implicitly be a subconference, which thus also could be called a "comment tree". Thus, every notice which is NOT a comment on a previous notice becomes the head of a new comment tree.

A simple and general purpose basic structure

The structure with conferences and news control in conferences, which is common to most computer conference systems, is generalized further in COM/PortaCOM into a simple and general-purpose basic structure. The data base of the system can store messages, which are texts of arbitrary length. The data base can also store users, people who are using the message system.



This figure shows the data base structure of COM/PortaCOM, with links between messages and activities containing lists of links to messages.

A message can belong to one or more ordered sets of messages. Such a set can for example be the letters to or from a certain person, or the messages in a conference. We use the word activitity for such a set of messages. An activity also has a name and a list of users who are members of the activity, and a sequential list of references to messages. One message can be entered into several activities. Only one copy of the message text is stored, with references from the activities to the message text.

Every user has a personal mailbox, which is an activity containing letters to and from this user. A user can also create additional personal activities and sort messages by entering references to them in one such personal activity. A computer conference is an activity with several users as members, who normally can both read and write messages in the conference.

Example: A certain message may be entered into the three activities "Joan Smith", "COM experience" and "PortaCOM development". This message is then available to "Joan Smith" as a letter and to all members of the conferences "COM experience" and "PortaCOM development" as a conference entry. When someone writes a comment to the message, the comment is sent to the same receivers so that all who read the original message also receive the comment. The comment is also sent to the author of the commented message, if this author is not a member of any of the other receiving activities. It is also possible to write personal answers which are only sent to the author of the message.

The receiver of a message can establish links to it (= send it along to) other activities (e.g. personal mailboxes or conferences).

Example of user dialogue of linking entries

First you read an entry which was in this case linked to two conferences and one personal mailbox, remotely accessible via mail networks.

```
(Text 22545) 83-09-05  22.27  Dennis Jennings  Univ. College Dublin
Receiver: Computer networks <94>
Receiver: IBM computers <43>
Receiver: NSINO1 ' RLGB.JNT-MAIL(Paul Bryant (on GEC 4090 - RLGB at
     Rutherford)) <7> -- Received: 83-09-06 05.02
Comment on: (Text 21135) by Ulf Beyschlag  CERN <1>
Subject:  BITNET
-----------------------------------------------------------------
See my earlier comment on IBM sponsorship of BITNET in Europe.
(Text 22545)-----------------------------
```

The comment command starts a new entry, with a comment link to the previous entry, and with receiver links to the same entries as the previous entry:

```
What do you want to do? (Read) next notice, Quit, Comment (on
entry), (Send a) letter (to), Personal (answer), Other.
- comm
Comment (on entry)

Receiver: Computer networks
Receiver: NSINO1 ' RLGB.JNT-MAIL(Paul Bryant (on GEC 4090 - RLGB at
     Rutherford))
Comment on: Text 22545 (by Dennis Jennings  Univ. College Dublin)
Subject:  BITNET
-----------------------------------------------------------------
```

During or after the writing of the new entry, the receiver links to it can be changed, for example using the move command which removes all existing receiver links and adds one or more new such links:

```
!move post at
Move (entry) POSTMASTER at QZ
POSTMASTER at QZ added as receiver

You are at the end of the entry.
Subject: Doing the rounds
Moved entry
!enter
Enter (it)
17.32 Letter (Text 30767) sent to:
POSTMASTER at QZ
New Userman

What do you want to do? (Read) next notice, Quit, Read (the)
rest, Comment (on entry), (Send a) letter (to), Personal (answer),
Other.
- type
(Re-)type (the text)

(Text 30767)     Today 17.32 New Userman
Receiver: POSTMASTER at QZ <924>
Comment on: (Text 22545) by Dennis Jennings Univ. College Dublin <1>
Subject: Doing the rounds
-------------------------------------------------------------
Moved entry
(Text 30767)-----------------------------
```

Example I: Electronic publishing

A new item is first sent by the author to an activity for incoming manuscripts. This is a closed activity, in which one or more of the editors can read. They look at the paper, and establish a new link from it to the personal mailbox of one or more referees. The comments by the referees are entered into a special activity for such comments, together with a reference link in the data base, connecting the comment to the original entry. The editor decides to accept the paper (possibly after revision by its author) and then establishes a link between the paper and the activity for published papers, e.g. the electronic journal itself. This activity is write-protected, so that only the editors can link items to it.

Example II: System development

A conference is opened for users of a certain software system. In this conference, a user suggests an improvement to the system. Some other users comment on this improvement. The system designers will then discuss how to implement this improvement in a closed conference for those responsible for development of the system. Even though their discussion is in a separate conference, it can still be linked to the original discussion, since commentary links in COM/PortaCOM can cross conference boundaries. When the change has been implemented, a comment is entered into the user conference again, commenting on the

original proposal and informing the users that now it has been implemented. Every user who asks the system to print-out all entries in a certain structure of directly and indirectly linked messages will only be shown the subset which s/he are allowed to see. Thus, the ordinary user will only be shown the discussion in the user conference, while the implementors will also be shown the discussion in their closed conference.

Example III: Selecting messages

Someone who reads in large public conferences can select messages of special interest to him/herself or someone else and link them to special selection conferences. For example, I select those messages which I think my boss should read, and send them along to him by linking them to his personal mailbox or to a closed conference for the two primary bosses of our computer centre. Selected messages can also be sent to public conferences, designed so that original entries can not be sent to them, only entries which have been referred there from other conferences.

Example IV: Telex handling

Suppose you want to introduce a system where all outgoing telexes have to be okayed by certain telex controllers. You can then create an activity for all suggested telexes, or, if you prefer, separate activities for suggested telexes, one to be handled by each telex controller. The telex controllers have the right to move entries from these activities to other activities of messages to be sent as outgoing telexes. The program which transmits outgoing telexes appears to the system as a special kind of human user, who takes messages from the activity for outgoing telexes and sends them. In the same way, incoming telexes can first be entered into a conference for incoming telexes, before a human decides to which activities to further the telex for handling.

Novice users need not see the advanced structure

To a novice user, COM/PortaCOM is a system for handling letters and conference entries. The fact that both letters and conference entries are handled by the general-purpose activity concept need not be understood by novice users.

Menu- and command-driven dialogue

A menu-driven user interface is easy to use for novice users. The users are presented with alternatives and tell the computer what they want to do by choosing one of the alternatives. Experienced users however, will find menus too long-winded and time-consuming. They want to be able to give a direct command to the computer to tell it what to do.

To make COM/PortaCOM suitable to all classes of users, the systems use a combination of menus and commands in its user interface. A typical menu might look like this:

> What do you want to do? (Read) next notice, Quit, Comment (on entry), (Send a) letter (to), Personal (answer), Other.
> -

When you get such a menu, you can type a command chosen from the menu, e.g.:

> - next notice

However, you need not choose from the menu only. Any valid command is accepted. The menu is just a guide-line from the system to the user. Experienced users can ask the system not to show the menus so as to make it more like a normal command-driven computer system.

The menu choices are intentionally not numbered, since we want you to learn the commands, not learn the numbers of menu choices. In this way, the system helps you to learn more about the system. To answer with command names is just as easy as to answer with numbers, since, as long as it is not ambiguous, every command can be shortened, for example "next notice" to "n n".

If you give an ambiguous command, the system will simply type out the alternatives and let you input the command again. Example:

> - li co
> Ambiguous command. Do you refer to one of the following?
> List commands, List conferences.

Names of activities (users and conferences) can be abbreviated in the same way as commands. The system repeats the command in full so that you can check that you were correctly understood. Example:

> - jo co ex
> Join (conference) COM experience

In order to make COM/PortaCOM easier to use for inexperienced users, the system tries to anticipate user needs. Thus, the system does not use fixed menus. Instead, the main menu is composed individually for each user on the basis of what the system knows about that user.

For example, if you have just read a message (and might thus want to "comment" on this message) and if you have more unseen messages in the same activity (and might thus want to read the "next notice" in the activity), the menu might be:

> What do you want to do? (Read) next notice, Quit, Comment (on entry), (Send a) letter (to), Personal (answer), Other.
> -

The first menu alternative is the most commonly used alternative. If you just reply to a menu question by hitting the RETURN key, this is interpreted as the first menu alternative. For example, when you have unseen notices in the same activity, then the RETURN key will cause the computer to type out the next unseen notice.

When you have read all notices in one conference, but have unseen notices in other conferences, the first menu alternative is "(Join) next conference" so that the RETURN key will cause the computer to join the next conference in which you have unseen notices.

Thus, by only pushing the RETURN key, you can go through all unseen notices in all activities where you are a member. You can go through the activities in a personally chosen order by using the "Join" command, but if you do not make such conscious decisions, COM/PortaCOM will go through them in a standard order. You can modify this standard order to your own preferences.

Parameters not given are defaulted or asked for

Certain commands take one or more parameters. If these are not given with the command, COM/PortaCOM will in some cases assume a default value (such as the last seen message when giving the "comment" command), and sometimes ask for the missing parameters.

Example:

```
- Cha na Ja Pal
Change name (of) Jacob Palme

Please give a new name:
-
```

Any command can be given at any time

In normal human communication, an action can always be interrupted by a command not belonging to that action. For example, when someone asks you about the weather, you can reply with the question "are you going out" instead of answering the question. In the same way, we have tried to design COM/PortaCOM so that any command can be given at almost any time. Also, an action is easy to interrupt by simply not answering the subquestions. For example, if in the example above you do not want to change the name, you simply push the RETURN key instead of giving a reply to the request "Please give a new name:" and COM/PortaCOM will then return to the main menu again.

Handling new users

The menus are composed individually for each user at each time, depending on their needs. Thus, a new user is greeted by a special menu with list conferences first in the menu and the join (conference) command later in the menu, since the system expects new users to want to find and join new conferences.

```
You are not yet a member of any meeting.

What do you want to do? List conferences, (Get) daytime, Quit,
Join (conference), (Send a) letter (to), Other.
= list conf
List conferences

(* marks meetings you are not member of)
  Entr   Memb    * Name (Type)

   301    132      * TOPS-10/20 SIG (Open)
   565    125      * Packet-switched network use of COM (Open)
    19     23      * Euronet user forum (Closed)
   775    154      * Presentation (of new) COM users (Original open)
   190     59      * Bioconversion technical (Closed)
  1303     12      * COM administrator (Closed)
             8      * US-Europe CS collaboration (Closed)
    12      6      * QZ Customer Service (Closed)
   339     47      * IEA BLTF (Closed)
   923     10      * POSTMASTER at QZ (Closed)
   402     17      * Presentations (of new) external COM names (Write
                     protected open)
   165     33      * GILT closed meeting (Closed)
    28      7      * QZ COM development (Closed)
   103     12      * YORK QZ UIO cooperation (Closed)
  1171     15      * Mail transfer (between) York (and) QZ COM/POST
                     systems (Closed)
   133     79      * Computer networks (Open)

What do you want to do? List conferences, (Get) daytime, Quit,
Join (conference), (Send a) letter (to), Other.
= join comp net
Join (conference) Computer networks

You are not a member of Computer networks

Do you want to become a member? No, Yes.
= yes
Yes
You are now member of Computer networks
============================================================
The title of the activity is: Computer networks

You have 133 unseen entries                        Monday 17.30

What do you want to do? (Read) next notice, List conferences,
Quit, Other.
-
```

Retrieval

COM/PortaCOM has facilities for searching for and retrieving notices from the data base using a number of search parameters such as conference, author, subject, words in the text etc. Note also, that since COM/PortaCOM allows a notice to be linked to more than one conference, the set of conferences, to which a text item is linked, is a concept

very close to the set of keywords on a text item in an information retrieval system, and the conference links are used for retrieval in similar ways as keywords are used in information retrieval systems.

Statistics

COM/PortaCOM collects statistics on use both globally and individually. The individual statistics are only available to the person concerned, and can also, in protected ways, be made available to researchers who need them for research on the use and effects of the system.

System interconnection

Software for interconnecting COM systems on several computers, including the establishment of parallel conferences, has been developed. This software also links COM to the international academic mail networks (MAILNET, BITNET, CSNET, JNT-MAIL etc.).

Similar software is under development for PortaCOM.

Summary of COM/PortaCOM facilities

Function	Implementation
Implementations	COM has been in production usage for several years at about 15 DECsystem-10 and DECsystem-20 installations. PORTACOM is under development or fieldtesting for Norsk Data Nord-100, Burroughs B 7800, CDC Cyber/NOS, Digital Vax-11/VMS, IBM 370/VS1, IBM 370/MVS-TSO, IBM/VM-CMS, Siemens 7.760/BS 2000 and Univac 1100 computers. PORTACOM will probably also be implemented on Vax-11/Unix systems.
User interface	Individually composed menus but in reality command driven, since any command can be given to any menu.
Help facility	"Help <command>" describes that command.
Text data base	The text data base consists of a text directory and a number of text items.
Links between texts	"Comment" links can be established between text items. Several comment links can refer to the same item creating recursive tree structures.
Conference data base	A conference consists of a list of members and a list of links to text items. The same text item can be referred to from several conferences. Links from a conference to a text item can be of type "Receiver" and "For information".

Conference types	Conferences can be of several types, the most important being: OPEN, where any user can join the conference, CLOSED where the organizer decides who can participate, RESTRICTED which are OPEN to some users and CLOSED to other users, WRITE-PROTECTED to which only the organizer can establish links from text items, PROTECTED where all information about the conference is hidden from non-members.
User data base	A user has a list of conferences, in which that user is a member. Every user has a "personal conference" storing letters to and from this user. One and the same text item can thus both be linked as a conference entry to one or more conferences and as a letter to one or more individual users.
Name data base	The name data base contains names of users and of conferences with links to the conference and user data bases.
News control	For every user who is a member of a conference, the system notes how far that user has read in the conference. This marker is updated whenever a new entry is read. A user can be automatically guided through all new letters and all new conference items, one conference at a time, but the user can choose a different path for scanning news and can modify the default path according to which conferences with news are presented. The same text item is not shown twice to a user, even if the user is a member of two conferences and the text item was sent to both conferences.
Text item retrieval	By conference, writer, receiver, item number, item range and (in PORTACOM) content. Comment chains can be traversed. Browse facility available. Items of interest can be marked by an individual who wants to see them again later.
Name data base	Names of users and conferences can be matched retrieval from abbreviated search words. In COM version 6, general text search is also available on the name data base.
File system interface	Text items can be saved on files, files can be submitted as entries or as command files.
Text editing	Simple text editor built into the system. COM version 6 also provides a facility for calling an arbitrary external text editor.
Terminal type modes	The system can be adjusted to different terminal types.

User modes	Some user interface facilities can be adjusted according to individual user preferences.
Tables and statistics	Commands to print out lists of users and conferences, lists of members of a conference and usage statistics.
Disk cleaning	Automatic facilities for removing old text items when space is needed for new text items. (In COM version 5: By running a disk cleaning program. In COM version 6: Also old conferences and users are automatically removed when space is needed for new users or conferences.)
Text interchange	GILT and RFC (Arpanet, CSNET, MAILNET etc.) MAIL with other CBMS-es protocols available for COM, and will be developed for PortaCOM.
Special program interface	A "special program interface" is available which allows computer programs to act as "users" in reference to the system.

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Computer Conferencing is more than Electronic Mail

All good computer conferencing systems are also good electronic mail systems. But computer conferencing systems provide something more:

> The receivers of information have better facilities for controlling the communication process and avoid the problems with information overload which occur with all large electronic mail systems.

> Computer conferencing helps to establish communication between people who are distant geographically or organizationally. Sociological studies show that such people are more successful.

> Computer conferencing is much better suitable to group communication. The communication is both very fast and efficient and also psychologically well suited to communication even in larger groups than are suitable for face-to-face meetings.

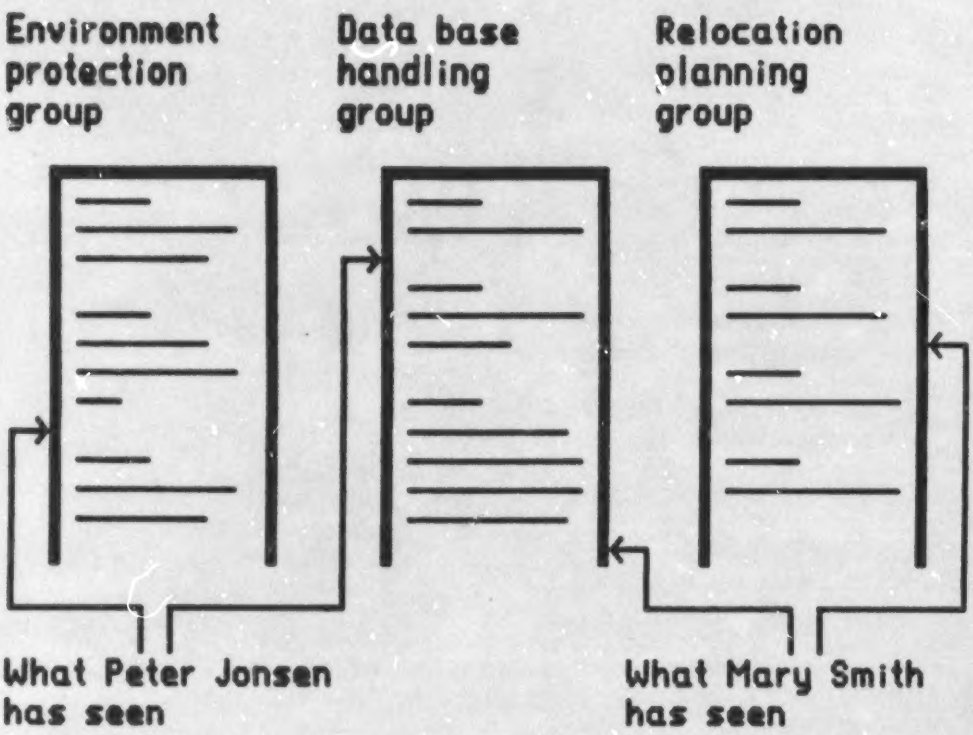
Functional differences between computer conferencing and electronic mail

Both electronic mail and computer conferencing is based on humans entering messages from computer terminals. Similar to both systems is also that the people communicating are rarely using the system at the same moment of time. This is an important difference from face-to-face meetings, where everyone has to meet at the same time.

In a pure electronic mail system, the sender of a messages enters from his/her terminal the names of those who are to receive the message. This facility is also present in computer conferencing systems. But messages in computer conferencing systems can also be sent to conferences. Messages sent to a conference are made available to (but not forced upon) all members of the conference. Conferences can be open (public) which means that anyone interested in the subject of the conference can join, or they can be closed, which means that the organizers of the conference decide who can take part in the conference.

Users of a computer conference system connect regularly, e.g. once a day to the system. They then read new letters to them and new messages in the conferences in which they participate.

For every user who is a member of a conference, the system keeps a counter of how far this user has read in the list of messages in this conference. The user is shown only new messages when connecting to the system. Users can however review old messages if they wish to do so.


Environment protection group
Data base handling group
Relocation planning group
What Peter Jonsen has seen
What Mary Smith has seen

This figure shows the main principles of the news control facility in a computer conference system. In the figure, Peter Jonsen is a member of the first and second conference, and Mary Smith is a member of the second and third conference. There is a pointer in the data base for each person and each conference of which this person is a member. This pointer shows how far that person has read. Thus, users can enter the system at different times, and the system can show each user what is new to that user. If a user has been away for a few days, s/he will not miss anything. The number of entries below the marker will simply be larger than if a user connects more often.

Distribution of control

There are at least three parties involved in a communication process: The sender of a message, the receiver of a message and the organization using the communication system. More control for one of these three parties may mean less control for the other parties. A good computer conference system tries to achieve a balance of control between them. There is reason to believe that this will give a better communication process than a system where the communication process is too much controlled by one of the parties.

In a system where the communication process is too much controlled by the sender of the information, problems with information overload will for example often occur. This is the case with most electronic mail systems, where the sender of a message has almost all the control, deciding which people are to read the message sent.

All control with the sender	- Balance of control -	All control with the receiver
Electronic Mail system	Computer conferencing system	Typical information retrieval system

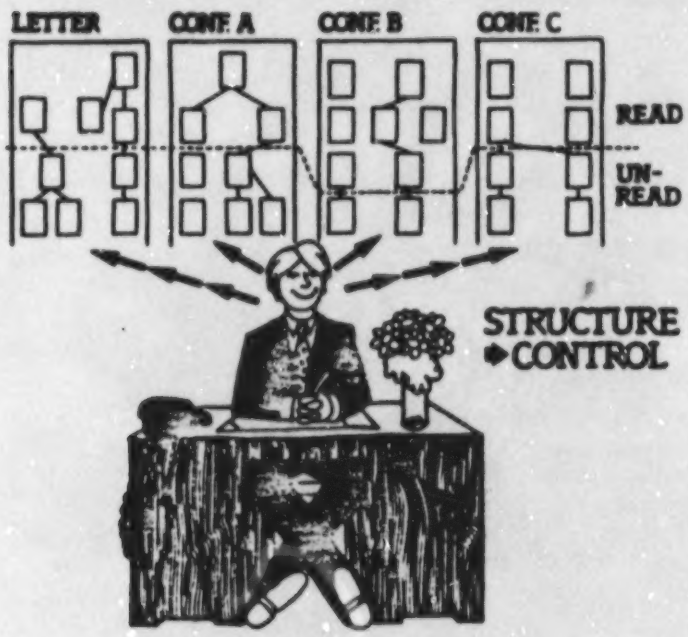
This balance of control is achieved in the following way:

The sender of a message in a conference system can tell the system the names of one or more people who are to receive a message. In this case, the sender has full control of the receiver list. The receivers can send the message along to other people, but this is still a control from the sender, since the receiver now acts as a new sender.

92 % of all messages read in the COM computer conference system are however conference notices, not personally addressed letters. In this case, control is distributed between the sender, the receiver and the organizer. The sender decides to which conferences the message is sent. The organizer can remove messages from a conference which do not belong to the subject of the conference. For open conferences, the receiver decides which conferences to join. For closed meetings, the organizer decides who are allowed to participate, but a conference participant can always withdraw from a closed conference. The receiver decides the priority in which different conferences are to read.

Information overload

If all messages were sent from one person to one other person, information overload would very seldom occur, since the time to write a message is so much larger than the time to read that people would spend most of their time writing, and only a little time reading. With the advent of distribution lists, however, it becomes as easy to send a message to ten or a hundred or even more people than to send it to only one person. And the fact that computer mail systems make it so easy, through distribution lists, to send the same message to very many people, is the main cause of the information overload problem.



When message systems grow larger, or get connected via networks, the audience you can reach with a message gets larger, the distribution lists get longer, and the information overload problems get worse.

To avoid information overload, a system must give the recipients of messages better ability to choose what they want to read and not to read.

Such structuring is achieved in computer conference systems, as is shown in this figure.

Messages are structured by conference, and within each conference some systems provide additional structure like the links between entries shown above. These structures can be used by the receivers to control what they will receive, and when.

More communication between distant people

This table shows how much of the communication in a large research institute using the COM computer conference system which went between people who were close and distant in the organization.

	Using the mail facility	Using the conference facility
Communication between people within one department	77 %	38 %
Communication between people in different departments	23 %	62 %

These results show that there is a difference between who communicates with whom using the mail and the conference facility in the system. The mail facility gives more communication between people who are close geographically or organizationally and who know each other well. The conference facility gives more communication between people who are far away and do not know each other. The reason for this is that the sender of a conference entry need not know the names of all the people who are to receive the entry.

A computer conference system provides an environment where people can "meet" and exchange ideas much more freely than in a mail system. Contacts between people who did not know each other before are much easier to establish in a conference system than in a mail system. A conference system will much more easily provide cooperation and a feeling of togetherness between widely dispersed people. People who regularly use computer conferencing say that a whole new dimension of contacts and communication has opened up for them, and that they cannot understand how they were able to live in the seclusion before they started using the conference system.

What then, is the effect of the increased number of contacts at large organizational and geographical distances, which computer conference systems give. This has been studied in sociological research. This research shows that people having such contacts are more successful. They tend to be less conservative, they will easier accept new ideas and they are less prone to get stuck with bad or suboptimal solutions to their problems.

Larger groups work better

The figure below shows an important difference between computer conferencing and ordinary face-to-face meetings. The figure illustrates a group of 12 people communicating.

Conference system: Longer writing time but shorter reading time

Writing	Reading	Total time
3.6 min.	11 times 0.47 = 5.2 minutes.	3.6 + 5.2 = 8.8 minutes.

Ordinary meeting: You talk faster than you write, but you listen slower than you read:

Total time for talking and listening: 12 times 1.7 = 20.4 minutes.

Communication through a computer conference system is thus more efficient with time. If the time and cost of travel is included, the conference system is of course even more efficient. Studies on the COM computer conference system shows that if the same communication which takes place in COM would be performed through face-to-face meetings, the cost would be more than ten times larger. This estimate includes both travel costs, computer system costs and the value of the time of the people who use the system.

The reason why the reading time is shorter in the conference system is not only because people read faster than they listen, but also because a conference system allows every participant to decide how much time to spend on each message. You can read carefully items of importance and skip items with information you already know or which is of no interest to you.

This difference is not only an efficiency factor. It is also important psychologically. With twelve participants, as in the example above, every person uses about a third of his/her time giving information and about two thirds of the time receiving information, in the computer conference system. In an ordinary face-to-face meeting, they would on average talk 8 % of the time and listen 92 % of the time. Communication works psychologically better with computer conferencing, because you are not forced to be a passive listener as much as in face-to-face meetings. This also means that computer conferences can work well even in group sizes of 30-100 people which would be very difficult to manage in face-to-face meetings.

This fact is also one reason why people who regularly use computer conferencing systems feel that a whole new vista of contacts and communication has been opened for them. Group communication in large groups was simply not psychologically possible for them before, at least not so much in so little time as with computer conferencing.

The marginal cost of letting one person more take part in the communication is much lower with computer conferencing than with face-to-face meetings. This makes it economically possible to have larger group sizes, which means that more people can contribute with ideas and thus improves the quality of the result.

Distribution lists

Some electronic mail systems have distribution lists. You can send a message to a distribution list, and it will then be sent to all people on the distribution list. Note that this is not at all the same thing as computer conferencing. Much use of such distribution lists will cause severe information overload problems, while computer conference systems provide a way of solving this problem. The importance with computer conferencing is not only that messages can be sent to a group of people, but also that the receivers can decide which conference to take part in, and in which order to read news in different conferences.

The COM and PORTACOM systems

COM and PORTACOM™ are two functionally similar computer conferencing systems. Basic principles of COM and PORTACOM is to base the systems on a very general-purpose basic data base structure. On top of this general-purpose data base structure is built a user interface which is designed to be both very easy to use for the beginner and very powerful for the advanced user at the same time.

The data base consists of one area storing entry texts, one area storing users and conferences, and one area storing links between the texts, users and conferences. A text can be sent to any number of users or conferences by establishing links between the text and the receivers, a user can become a member of a conference by establishing a link between the user and the conference.

The user interface uses a combination of menus and commands. Novice users are guided by menus, but any command to the system can actually be given at any menu, and the menu alternatives are actually only a selection of the system commands. In this way, the system is easy to use for beginners because of the menus, but powerful for the advanced users since any command can be given at any time.

COM was originally developed for the DECsystem-10 and DECsystem-20 computers. PORTACOM is a portable version of COM, written in Pascal, and its development is financed jointly by nine European countries. PORTACOM is presently (October 1984) running on Univac 1100, VAX-11/VMS, IBM/MVS and IBM/VM computers, and version are also developed for Norsk Data Nord-100, IBM/VSI, Burroughs 7800, Siemens B-2000 and Control Data Cyber. Implementations on 32-bit micros, VAX-11/Unix and other computers are also planned.

Interconnection of conference systems

An important property of some mail systems is that many mail systems on different computers can be linked together, so that you can send messages from one computer to another. This will allow a person to read and write all his mail on one single computer, instead of having to log in to many different computers.

Some computer conference systems provide similar facilities. Mail will then be handled similarly to with inter-linked mail systems, and conferences can be run in parallel between many computers, with each entry sent to all computers where a parallel copy if the conference exists. A full copy of the conference is thus kept on all sites where they have one participant.

Users of mail systems can also participate in conferences, the conference will then look like a mailing list to them, sending them the entries as mail messages.

COM has had facilities for interlinking COM systems, both for mail and conferences, since 1979. COM can today (1984) communicate in this way using the RFC821/822 mail protocols used by ARPANET, MAILNET, CSNET, JANET etc. Such facilities will be developed also for PortaCOM, and COM and PortaCOM will also get support for the CCITT X.400 (MHS) protocols for interlinking mail systems.

The joint European project GILT (comprising 9 European countries) has developed a protocol for interlinking mail and conference systems which has better facilities for interlinking conference systems than the RFC821/822 and the CCITT X.400 protocols.

Most standards for interconnecting mail systems provide only two functions, a SEND-MAIL and a NAME-SERVER function. GILT defines many more functions, for example the establishment of a parallel conference at several computer sites with automatic exchange of messages and the facility for one system to read messages from the data base of another system.

References

FOA reports below can be ordered from Rapportcentralen, FOA 1, Box 27322, S-102 54 Stockholm, Sweden. QZ reports can be ordered from QZ, Box 27322, S-102 54 Stockholm, Sweden.

Information about the availability of the COM and PORTACOM computer conference systems can be obtained from the QZ Computer Centre, Box 27322, S-102 54 Stockholm, Sweden, phone +46-8-67 92 80. In North America, information is also available from Dan Oberst at Edunet, P.O. Box 364, Princeton, New Jersey 08540, phone (609) 734-1915. The systems are available both for installation on your own computer and for use through international computer networks (EURONET, DATEX-P, TELENET, TYMNET etc.) links to QZ in Sweden.

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Effects of the COM computer conference system

COM is a computer conferencing and electronic mail system used by thousands of users at many different computer installations.

Messages in COM can either be sent as letters, where the sender gives the names of all the people who are to receive the letter, or as conference entries, where the sender gives the name of the conferences to which the entry is sent. All members of a computer conference can read all entries in the conference and usually also write their own entries into the conference.

This is a short summary of a longer report "Experience with the use of the COM Computerized Conferencing System", reporting on the experience with COM usage mainly at the original site in Stockholm with a user population of a few hundred people. The longer report can be ordered for a price of 25 Swedish kronor from FOA 1 Rapportcentral, Box 27 322, 102 54 Stockholm, Sweden.

Letters or conference entries

	Letters	Conf. entries	All messages
Mean no. of readers	1.9	32.9	14.1
Percentage of no. of written messages	61 %	39 %	100 %
Percentage of no. of read messages	8 %	92 %	100 %
Percentage of user time spent writing	23 %	17 %	40 %
reading	8 %	51 %	60 %
total time spent	32 %	69 %	100 %

Conclusion: There is a large difference between letters and conference entries. Although 61 % of all messages written in COM are letters, the letters represent only 8 % of all messages read in COM and only 32 % of the total user time is spent on letter communication.

Time spent in COM

An average user connects to the COM system twice every working day or ten times a week. Each session lasts 10 minutes, so COM is used about 100 minutes/week or about 4 % of the working time. During one such week, an average user reads 131 messages and writes 6 messages.

Conclusion: COM does not dominate the time usage of its users, but quite a lot of communication is done during the 2^ minutes a day spent using COM.

When is COM used and from where?

62 % of the COM usage is done during office hours (monday-friday between 08:00 and 17:00 hours). 38 % of the COM usage is done outside office hours. 9 % of the COM usage is done from terminals at home, 91 % from terminals at the place of work. The high percentage of COM usage outside office hours shows the advantage of a medium which can be used at any time when the user wants, and where everyone does not have to collect at the same place and time.

Speed of the medium.

The median time from the writing of a letter to the time it is read is 5.5 hours and the median length of a discussion on a particular subject in COM is 23 hours. This can be compared with a face-to-face meeting, where the mean time before the next meeting is usually one or two weeks. So COM is a very fast medium in spite of the fact that all participants do not meet at the same place and time.

Organizational distance between users

This table shows how much of the communication in COM during a test week in 1980 went between people who are close or distant within the FOA organization which at that time was the main user of COM.

	Letters	Conf. entries	All messages
Within one FOA main department	46 %	18 %	21 %
Between FOA main departments	14 %	29 %	28 %
Between people in and outside FOA	31 %	40 %	39 %
Both reader and writer outside FOA	9 %	13 %	13 %
Total	100 %	100 %	100 %

Conclusion: Letter communication, where you have to know the name of the person you are sending the letter to, tends to favour communication between people who are organizationally close. Conference communication on the other hand makes communication possible between people who are organizationally distant from each other.

This is interesting because sociologist have found (Allen 1977) that organizations with more contacts at large organizational distances tend to produce better results. They are more willing to accept new ideas and less prone to get stuck with non-optimal patterns of work. Computer conferencing favours such contacts over large distances much more than computer mail.

Does COM replace other media?

The communication done through COM would otherwise have been done in the following ways:

Replaces	Percentage of written messages	Percentage of read messages	Percentage of time spent using COM
Letters, handwritten notes, circulars	7 %	4 %	6 %
Telephone calls	23 %	8 %	14 %
Different kinds of face-to-face meetings	17 %	11 %	13 %
New communication which would not have occured without COM	50 %	75 %	65 %
Other media	3 %	2 %	2 %
Total	100 %	100 %	100 %

Conclusion: Most use of COM is not a replacement for other communication media. Instead, COM represents new communication which would not have been feasible without COM. COM has thus not only or mainly meant the transfer of communication to a new medium. COM has meant a change in whom people communicate with, probably also in what they communicate with these people about. People perform their work and solve their problems i a different way using COM. A new kind of community of people is created which did not exist before.

The time spent using COM would otherwise have been spent in the following ways:

23.2 %	Telephoning
12.1 %	Letters, circulars, messages
10.9 %	Computer programming, research, technical development
9.3 %	Leisure, sleep, eating, hobbies, family, friends, exercise
8.0 %	Books, papers and journals
7.5 %	Dead time
5.4 %	"Other work" (not specified)
5.4 %	Committee and conference meetings
4.8 %	Television and radio
4.7 %	Nothing
3.7 %	Face-to-face talks
1.8 %	Breaks, small talk
1.4 %	"Don't know"
1.4 %	Planning
0.4 %	Travel
100.0 %	Total

Conclusion: Note that although this kind of system is usually called "Computer conference system" or "Electronic mail system" only 5 % replaces conferences and 12 % replaces mail. Instead, COM also replaces a number of other activities. Notable is telephone with 23 %, mass media 13 % and non-work 9 %. Note also that only about 10-15 % of the time using COM would otherwise have been spent in face-to-face meetings. The fears that these kind of media will stop people from meeting face-to-face thus do not seem founded in reality.

Which people use COM?

Percentage of persons who are bosses in different groups

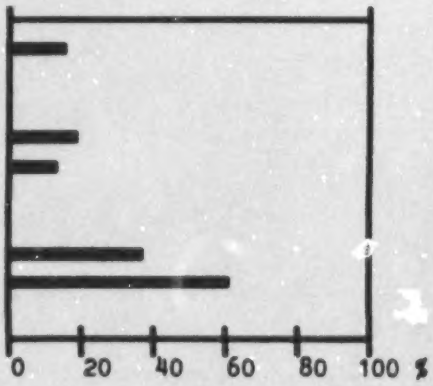
15 % Of all FOA employees . . . . . .

Of COM users

18 % Of all COM users . . . . . .
13 % Of very active COM users . . . .

In working groups (not in COM)

37 % OF all members of working groups
61 % Of those in four or more groups .



Percentage of people above 40 years of age in different groups

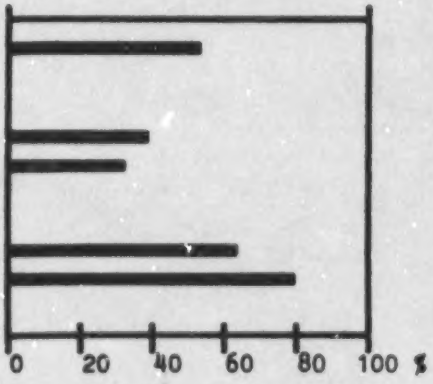
53 % Of all FOA employees . . . . . .

Of COM users

38 % Of all COM users . . . . . .
32 % Of very active COM users . . . .

In working groups (not in COM)

63 % Of all members of working groups
79 % Of those in four or more groups .



Percentage of people with university education in different groups

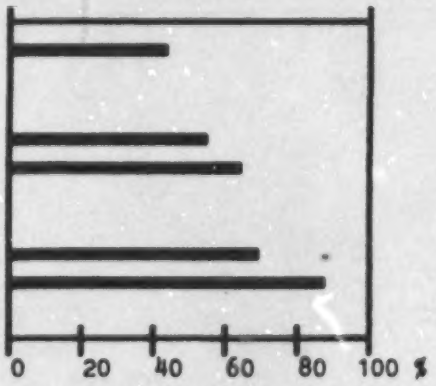
43 % Of all FOA employees . . . . . .

Of COM users

54 % Of all COM users . . . . . .
64 % Of very active COM users . . . .

In working groups (not in COM)

69 % OF all members of working groups
87 % Of those in four or more groups .



Conclusion: COM has increased the possibility to communicate in groups of people at organizational distance. This increase in communication is largest for young people who are not bosses and to some extent for people without university education.

Effects on the social interaction

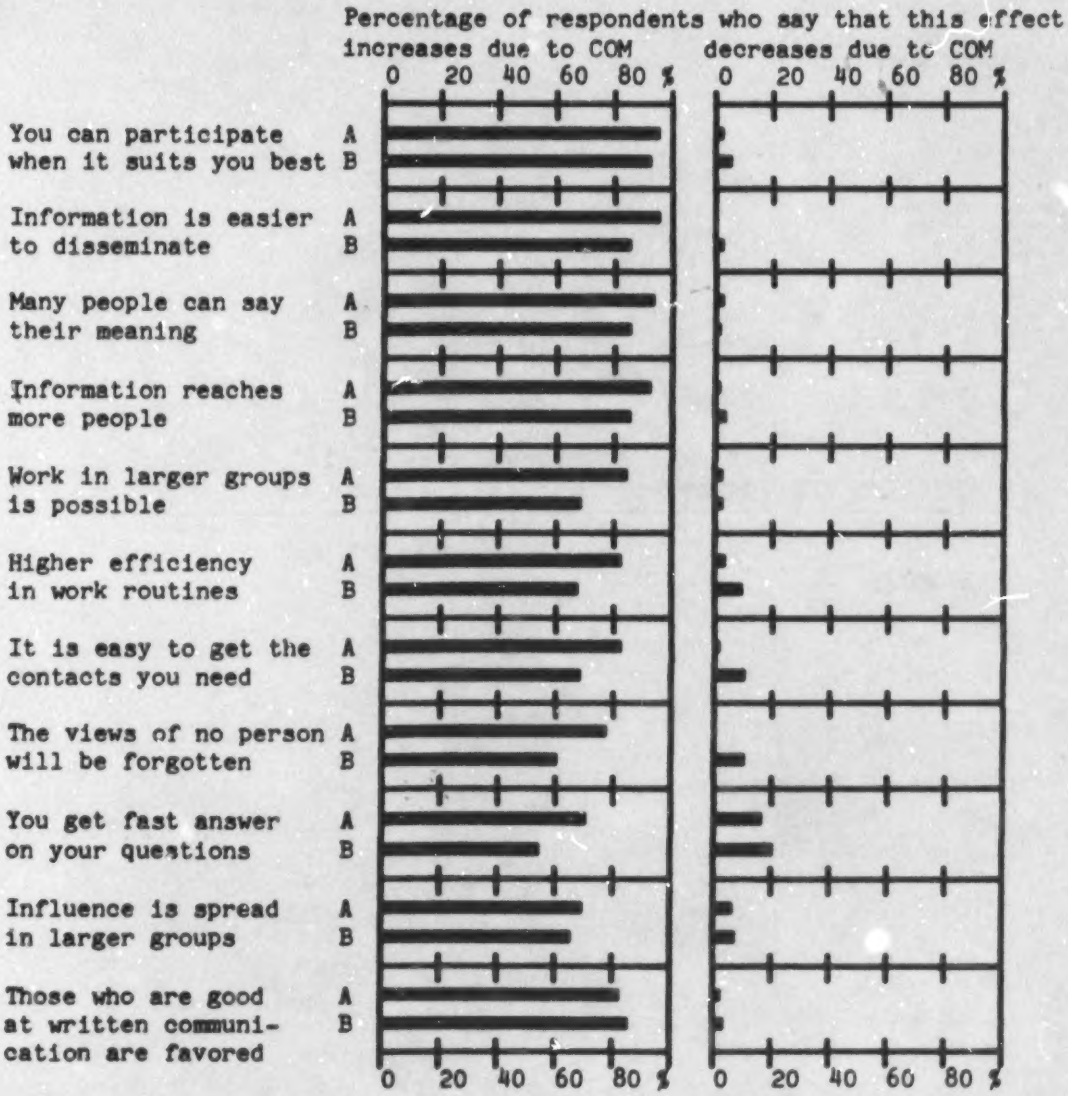
An american sociologist Roxanne Hiltz has conducted a controlled experiment where a number of groups solved similar problems using both computer conferencing and face-to-face meetings.

Her results show that computer conferencing gives more equal opportunity for all participants to say their view, while face-to-face meetings more lets one person dominate the discussions in the group. It is easier to reach a unanimous decision in a face-to-face meeting, easier to get a comprehensive presentation of all arguments for and against different solutions when computer conferencing is used.

User opinions on COM

A swedish psychologist Lillemor Adriansson has studied the opinions of the COM users on the system. Here is a listing of those properties which COM has according to more than 60 % of the COM users:

A indicates experienced users, B less experienced users of COM.


Percentage of respondents who say that this effect
increases due to COM
decreases due to COM
0 20 40 60 80 %
You can participate when it suits you best
Information is easier to disseminate
Many people can say their meaning
Information reaches more people
Work in larger groups is possible
Higher efficiency in work routines
It is easy to get the contacts you need
The views of no person will be forgotten
You get fast answer on your questions
Influence is spread in larger groups
Those who are good at written communication are favored
A
B

Cost of using COM

The total cost of using COM (computer time, terminal cost, network cost, program development cost etc. but not including the salaries of the COM users) is about 70 Swedish kronor for each terminal hour for FOA and local universities. The cost for other universities is about 105 Swedish Kronor for computer time only, and for commercial users about 240 Swedish Kronor for computer time only. These fares apply during prime time, and are are reduced by 30 % in the evening and by 60 % in the night and on Saturdays and Sundays. (One US dollar is about 6 swedish kronor.)

The cost of writing a COM message based on the fares for FOA is about 5 kronor for the equipment and 6 kronor for the salary of the COM user. The cost of reading a COM message is about 0.55 kronor for the equipment and about 0.67 kronor for the salary of the COM user.

An estimate on an average conference in COM shows that the cost of holding this conference by face-to-face meetings would be ten times higher (including computer costs, travel costs and the value of the time of the participants).

Cost comparison with face-to-face meetings

This comparison is based on a meeting with 12 participants.

Conference system: Long writing time but short reading time:

Writing	Reading	Total time
3.6 min.	11 times 0.47 = 5.2 minutes.	3.6 + 5.2 = 11.2 minutes.

Face-to-face meeting: Shorter speaking time but longer listening time:

Speaking and listening: 12 times 1.7 = 20.4 minutes.

Travel costs and computer costs are not included in the comparison shown in the figure above.

Including all costs: In another study, the cost of performing an average experience exchange conference in COM with 34 participants, 21 in Stockholm 12 in other Swedish cities and 1 in Oslo, was computed. In this study, all costs - wages, travel costs, computer time etc. was included. The study found that face-to-face meetings once a month would cost about five times as much as COM usage. The value of the faster communication in COM compared to face-to-face meetings was not included in the study.

Conclusion: COM is more efficient than face-to-face meetings when the group size is larger than 5 participants or when some participants otherwise would have to travel. A requirement is also of course that the communication is of a kind for which computer conferencing is a suitable medium.

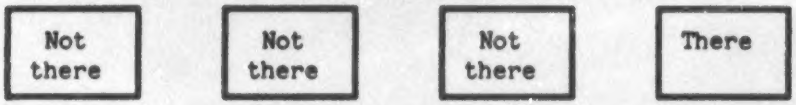
This difference is also important from a psychological viewpoint. With twelve participants as in the example above, everyone will when using COM spend about one third of the time giving information and two thirds of the time getting information. In the face-to-face meeting, only 8 % of the time will for a mean participant be spent talking and 92 % spent listening. Communication works psychologically better if you are not forced to be passive so much as in large face-to-face meetings.

COM has meant a large increase in interactive group communication in groups of between 20 and 100 people, simply since interactive group communication in such large groups was previously not possible at a reasonable cost.

Cost comparison with a telephone call

A large part of the cost of a telephone call is the time spent before a successful telephone connection is reached.

Telephone call:



2.6 + 1.0 min. | 2.6 + 1.0 min. | 2.6 + 1.0 min. | 5.5 + 1.0 + 4.5 min.

Total: 22 minutes.

Conference system:

Writing 4.2 min. Reading 0.5 min.

Total: 4.7 minutes.

Conclusion: Computer mail and conferencing is cheaper than a telephone call if less than five messages can do the same work as one telephone call. If more than two people are involved, the cost of telephone rises sharply but the cost of computer conferencing rises very little.

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